

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :  
Takeshi KURIBAYASHI et al. :  
Serial No. NEW : **Attn: Application Branch**  
Filed June 18, 2001 : **Attorney Docket No. 2001\_0771**

ELECTRONIC COMPONENT AND MOUNTING  
METHOD AND APPARATUS THEREOF  
(Rule 1.53(b) Continuation  
of Serial No. 09/319,779,  
Filed June 11, 1999)

THE COMMISSIONER IS AUTHORIZED  
TO CHARGE ANY DEFICIENCY IN THE  
FEE FOR THIS PAPER TO DEPOSIT  
ACCOUNT NO. 23-0975.

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**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents,  
Washington, DC 20231

Sir:

Kindly amend the above-identified application as follows:

**In the Abstract:**

Kindly replace the original abstract (page 63) with the enclosed substitute abstract.

**IN THE SPECIFICATION**

Between the Title and "TECHNICAL FIELD" (lines 4 and 5) insert the following continuing data information paragraph :

This is a continuation application of Serial No. 09/319,779, filed June 11, 1999, which is a national stage application of PCT International Application No. PCT/JP97/04578 filed December 12, 1997.

**Please replace the sub-heading beginning at page 1, lines 6-7, with the following rewritten sub-heading:**

#### BACKGROUND OF THE INVENTION

##### 1. Technical Field

**Please replace the sub-heading beginning at page 1, line 16, with the following rewritten sub-heading:**

##### 2. Description of Related Art

**Please replace the sub-heading beginning at page 9, line 7, with the following rewritten sub-heading:**

#### SUMMARY OF THE INVENTION

**Please replace the sub-heading beginning at page 22, line 16, with the following rewritten sub-heading:**

#### DETAILED DESCRIPTION OF THE INVENTION

**Please replace the paragraph beginning at page 24, line 9, with the following rewritten paragraph:**

Fig. 2 is a block diagram showing the outline of a control section for executing mounting control of the component mounting apparatus. In Fig. 2, reference numerals denote respectively, 20 a storage section provided with a mounting program storage section 20a and a component data storage section 20b, 21 an input/output control section, 22 a component supply control section, 23 a recognition control section, 24 a positioning control section, 25 a pressure control section, 26 a height control section, and 300 a CPU. The mounting program storage section 20a stores: mounting data such as a mounting sequence, component names, mounting positions (X, Y,  $\theta$ ), and supply positions of components to be supplied; and a program for executing the mounting process. The component data storage section 20b stores information such as component names, component (appearance) shapes (widths, lengths, heights), colors, reference mark positions with respect to component body dimensions (appearance or external ends) or reference mark positions with respect to the centers of the components, patterns (arrangement positions) of the lands of BG connecting portions with respect to the reference marks, reference mark shapes (the center of gravity and positions of the vertex and the sides in the case of a triangular reference mark; the center of gravity and positions of the corners and the sides in the case of a rectangular reference mark; the center or the center of gravity in the case of a circle or dot reference mark), the ball shape (including sphere, sphere diameter, and so on) in each arrangement position, information of the presence or absence of a ball, and so on. The CPU 300 issues whole mounting commands and instructions to each of the driving units and so on. The input/output control section 21 is to execute input and output of the mounting program and the component data by manual input or by an FD or communications. It is otherwise acceptable to directly execute the input and the output of data of the actual X- and Y-positions, angle, pressure, and the like on the component supply control section 22, the positioning control section 24, the height control section 26, and the pressure control section 25, not by way of the input/output control section 21. The component supply control section 22 drives the component supply section of a tray, a cassette, or the like, and then supplies an

appropriate component to a component supply position. The recognition control section 23 executes the recognition of the component, reference marks of the component and the board, IC marks, arrangement patterns, and so on, executes comparison with the data stored in the component data and the mounting program, and calculates a difference between them. It is to be noted that this calculation may be executed by another control section, CPU, or the like. The positioning control section 24 controls the X-Y driving and  $\theta$ -rotatory driving of the mounting head according to the above recognition information, while the pressure control section 25 controls the pressure in the mounting stage and component suction stage. The height control section 26 executes driving control of the mounting head in the Z-direction (the direction perpendicular to the X- and Y-directions). It is to be noted that the board conveyance is executed by a board conveyance control section 301.

**Please replace the paragraph beginning at page 30, line 2, with the following rewritten paragraph:**

On the lower surface of an IC chip 5b are preparatorily formed gold bumps 5d via aluminum electrodes 5c. This IC chip 5b is bonded with pressure via silver paste 5e on upper electrodes 5f of a single-layer or multi-layer carrier board 5a made of glass epoxy or ceramic and then encapsulated with resin to be formed into the complete BGA component 5. The BG connecting portions 6 are to be electrically connected to the upper electrodes 5f by wirings 5g that penetrate the carrier board 5a, and the reference marks 30 are formed simultaneously with each other on this carrier board 5a, as shown in Fig. 13A. Subsequently, the solder bumps 7 are formed. It is to be noted that the solder bumps 7 are not formed in the case of a bump-less component which needs no solder bump 7.

**Please replace the paragraphs beginning at page 36, line 3 through line 16, with the following rewritten paragraphs:**

In a board mounting position recognizing process, the target mounting position recognition marks 3D of the printed board 1 shown in Fig. 3A is confirmed and recognized by the board recognizing section 13b as needed (S6).

In a determination (check) correcting process after the mounting position detection, the mounting position is corrected by securing a high degree of accuracy through the mounting position determination correcting process together with the foregoing component inspection results (S7).

**Please replace the paragraph beginning at page 47, line 4, with the following rewritten paragraph:**

Fig. 11A is a front view of a two-dimensional bar code provided on the surface opposite from the surface that has BG connecting portions of a BGA component according to a sixth embodiment of the present invention, while Fig. 11B is a side view of the above. The bar code is provided on the surface opposite from the connecting surface described in connection with the fifth embodiment. If the two-dimensional bar code 40 is provided on the upper surface of the BGA component 5 and a variety of information for mounting the components, such as the land pitch and positional information of the BG connecting portions of the various components are coded as the indicated information, then the mounting control of the mounting head height, the mounting speed, the mounting pressure control, and so on in the mounting stage can be executed for each component on the basis of the information as the checking and correcting processes in the component recognizing process (process S4) shown in Fig. 4. Furthermore, a two-dimensional bar code 40 having a larger size can be used by providing the bar code on the surface opposite from the

connecting surface, and the information carrying area is enlarged to allow a wider variety of information to be provided. This operates favorably in controlling the mounting. If the amounts of deviation from the permissible range and the dropouts of the solder bumps are stored as information to be stored in the two-dimensional bar code 40 or another storage medium, then the information can be utilized as information for determining whether or not the component should be scrapped or reused with the solder bump reformed when the BGA component 5 is determined to be defective.

**Please replace the paragraph beginning at page 53, line , with the following rewritten paragraph:**

Furthermore, according to the present invention, the information of the coded reference mark(s) can assure an inexpensive and simple structure, without the necessity of providing a separate special device for executing detection, by virtue of the detection that is achieved and is also used for the recognition process.

**IN THE CLAIMS:**

**Kindly cancel claims 1-25 without prejudice thereof or disclaimer.**

**Kindly add the following new claims:**

26.(NEW) An electronic component to be mounted on a printed board, said electronic component comprising:

an electrical connecting surface;

a plurality of electrical connecting portions provided on said electrical connecting surface in arrangement positions; and

at least one reference mark that serves as a reference for the arrangement positions of said electrical connecting portions.

27.(NEW) An electronic component as claimed in claim 26, wherein said at least one reference mark comprises a pair of reference marks positioned symmetrically with respect to a center point of said electrical connecting surface, wherein said electrical connecting portions are disposed in an array that surrounds said reference marks.

28.(NEW) An electronic component as claimed in claim 26, wherein said at least one reference mark comprises a plurality of reference marks that are positioned symmetrically with respect to a center point of said electrical connecting surface, wherein

said reference marks are located in a central portion of said electrical connecting surface, and said electrical connecting portions are disposed around said reference marks.

29.(NEW) An electronic component as claimed in claim 26, wherein said reference mark is provided on a side of said electrical connecting surface that is adapted to faces a mounting position of the printed board.

30.(NEW) An electronic component as claimed in claim 29, wherein said reference mark comprises a projection or a printed symbol.

31.(NEW) An electronic component as claimed in claim 29, wherein said reference mark includes coded information indicative of said electronic component.

32.(NEW) An electronic component as claimed in claim 31, wherein the coded information of said reference mark is information concerned with a state in which the electrical connecting portions are formed.

33.(NEW) An electronic component as claimed in claim 26, wherein said reference mark is located in a corner portion of said electrical connecting surface.



34.(NEW) An electronic component as claimed in claim 26, wherein said reference mark is formed on said electrical connecting surface simultaneously with said electrical connecting portions.

35.(NEW) An electronic component as claimed in claim 26, wherein said electrical connecting portions are solder bumps.

36.(NEW) An electronic component as claimed in claim 26, wherein said electrical connecting portions are lands.

37.(NEW) An electronic component mounting method for taking out an electronic component from a component supply section and mounting the electronic component in a mounting position on a printed board, the method comprising:

recognizing, in a first recognition process, a reference mark that is provided on the electronic component to be mounted, wherein the reference mark serves as a reference of arrangement positions of electrical connecting portions provided on an electrical connecting surface of the electronic component and the printed board;

recognizing, in a second recognition process, a recognition mark for a target mounting position on the printed board;

checking the quality of the electronic component and correcting a positional orientation of the electronic component in a mounting stage in accordance with results of the first recognition process and the second recognition process; and

mounting of the electronic component if it has passed through the quality checking and positional correcting operations.

38.(NEW) An electronic component mounting method for removing an electronic component from a component supply section and mounting the electronic component in a mounting position on a printed board, the method comprising:

recognizing a reference mark that is provided on the electronic component to be mounted, wherein the reference mark serves as a reference of arrangement positions of electrical connecting portions provided on an electrical connecting surface of the electronic component and the printed board;

checking the quality of the electronic component or correcting the position of the electronic component in a component mounting stage according to a result of recognizing operation; and

mounting the electronic component, if it has passed through the quality checking or correcting process, in the mounting position on the printed board.

39.(NEW) An electronic component mounting method as claimed in claim 38, wherein the quality checking operation includes a component inspecting process for

checking the electronic component for a state of formation of the electrical connecting portions recognized based on a relative position with respect to the reference mark of the electronic component.

40.(NEW) An electronic component mounting method as claimed in claim 38, wherein a plurality of recognition marks of the target mounting position are provided on the printed board, and at least one of the recognition marks contains discrimination information of the electronic component to be mounted, the discrimination information being provided in the form of a two-dimensional bar code.

41.(NEW) An electronic component mounting method as claimed in claim 38, wherein the reference mark that is provided on the electronic component includes coded information concerned with the state of formation of the electrical connecting portions on the electronic component, and the electronic component is processed on the basis of the information contained in the reference mark.

42.(NEW) An electronic component mounting method as claimed in claim 38, wherein the reference mark, provided on the electronic component, is formed simultaneously with the electrical connecting portions.

43.(NEW) An electronic component mounting method as claimed in claim 38, wherein the electrical connecting portions are solder bumps.

44.(NEW) An electronic component mounting method as claimed in claim 38, wherein the electrical connecting portions are lands.

45.(NEW) An electronic component mounting apparatus characterized by comprising:

a component supply section containing electronic components, wherein each of the electronic components includes an electrical connecting surface, a plurality of electrical connecting portions provided on said electrical connecting surface in arrangement positions, and a reference mark serving as a reference for the arrangement positions of said electrical connecting portions;

a mounting head for moving the electronic components from the component supply section to a mounting position and mounting the electronic components on the printed board;

a mounting table for supporting the printed board;

a component inspecting section for recognizing the reference mark of the electronic component to be mounted on the printed board;

a board recognizing section for recognizing a recognition mark on the printed board, said recognition mark indicating the mounting position of the printed board; and

a control section for executing a quality check or a positional correction of the electronic component during a mounting stage of the electronic component.

46.(NEW) An electronic component mounting apparatus characterized by comprising:

a component supply section containing electronic components, wherein each of the electronic components includes an electrical connecting surface, a plurality of electrical connecting portions provided on said electrical connecting surface in arrangement positions, and a reference mark serving as a reference for the arrangement positions of said electrical connecting portions;

a mounting head for moving one of the electronic components from the component supply section to a mounting position and mounting the one electronic component on the printed board;

a mounting table for receiving the printed board upon which the one electronic component is to be placed;

a component inspecting section for recognizing the reference mark of the one electronic component to be mounted; and

a control section for checking the quality of the electronic component or correcting the position of the electronic component in an electronic component mounting stage in accordance with the result of recognition.

47.(NEW) An electronic component mounting apparatus as claimed in claim 46, wherein the component inspecting station is capable of recognizing coded information contained in the reference mark.

## REMARKS

The present Preliminary Amendment is submitted to replace claims 1-25 with new claims 26-47. Also, the specification and abstract are amended in a manner similar to that in the parent application Serial No. 09/319,779, thereby placing the application in better condition for examination.

Copies of the amended portion of the specification and abstract with changes marked therein is attached and entitled "Version with markings to show changes made."

The following comments are similar to those presented in the parent application and are presented for the Examiners consideration.

**Tagusa** discloses that as shown in Figs. 4 and 5, *"the drive IC 1 is provided with L-shaped alignment marks 18a and 18b in portions corresponding to the alignment marks 17a and 17b of the flexible wiring board 40"* on column 13, lines 51-52. That is, the marks 18a and 18b are served as the positions corresponding to the alignment marks 17a and 17b of the flexible wiring board 40, **but cannot serve as the arrangement positions of the electrical connecting portions of the drive IC 1.** Therefore, the arrangement positions of the electrical connecting portions of the IC can **not** be found or detected by observing or detecting the marks 18a and 18b, thus resulting in not solving the issues described in the present application.

**Yagi** discloses that "The lead wires of the circuit element E which has been subjected to the centering and turning treatment are observed by the camera 90 of the lead wire detection mechanism and a picture obtained is supplied to a position correcting operation unit or picture processing unit." on column 7, lines 34-39. That is, the lead wire of the circuit element that is located outside of the outline of the element is detected by the camera 90, and this information is used for the centering and turning treatment, **but cannot serve as the arrangement positions of the electrical connecting portions of the element.** Therefore, the arrangement positions of the electrical connecting portions

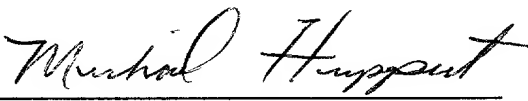
of the element can not be found or detected by observing or detecting the lead wire of the circuit element, thus resulting in not solving the issues described in the present application.

In the present invention, the reference mark is located within the outline of the component and serves as a reference for the arrangement positions of the electrical connecting portions arranged in dotted or island shape, not the position of the electrical component in order to solve the issues described in the present invention, that is, recognize the state of arrangement of the electrical connecting portions easily and correctly at high speed in mounting the electronic components such as: a BGA component represented by, for example, CSP having solder bumps for forming an electronic circuit; or a QFP component having no solder bump for forming an electronic circuit and satisfies a reliable component mounting quality of a high productivity.

In view of the above, it is submitted that the present application is in condition for allowance.

Respectfully submitted,

Takeshi KURIBAYASHI et al.

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## ABSTRACT

An electronic component, such as a BGA component, and a method of positioning with respect to a mounting head the component. The BGA component is positioned through positional detection of a reference mark and inspection, and the positional correction is executed by checking the holding posture. Through the inspection using the reference mark as a reference position, the dropout, dislocation, shortage of solder amount of the solder bumps of the component are subject to a quality check (S4). If of normal quality, the component is moved closer to the mounting position of the printed board on a mounting table by a mounting head (S5). A recognition mark in the target mounting position of the printed board is confirmed and recognized (S6). By determining the mounting position through mounting position detection and component inspection result, the mounting position is corrected (S7) and the height of the mounting head is controlled and the component is mounted (S8).

## DESCRIPTION

Version with Markings to  
Show Changes Made

## ELECTRONIC COMPONENT AND

## MOUNTING METHOD AND APPARATUS THEREOF

This is a divisional application of Serial No. 09/319,719, filed June 11, 1999.

## BACKGROUND OF THE INVENTION

⑥ ~~TECHNICAL FIELD~~1. *Technical Field*

The present invention relates to an electronic component having electrical connecting portions such as solder bumps or electrodes (lands, for example) exemplified by a solder bump component of a BGA (Ball Grid Array) type semiconductor component package (referred to as a BGA component hereinafter) represented by a CSP (Chip Size Package) or an electronic component such as QFP in forming an electronic circuit and relates to the mounting method and apparatus thereof.

⑥ ~~BACKGROUND ART~~2. *Description of Related Art*

In recent years, personal computers, portable telephones, information communications devices, multimedia electronic equipment, and the like have been compacted and provided with improved functions. Further, the electronic components and printed boards constituting electronic circuits have been made to have higher densities and finer constructions due to higher frequencies, and the mounting of components having a plurality of pins go mainstream in conformity to high-density circuits of QFP (Quad Flat Package) and the like. However, on increasing the density, the lead pitch of the connecting portions has been reduced in stages, for example, from 0.5 mm through 0.3 mm to the

ATTACHMENT B

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which is  
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12, 1997

portions easily and correctly at high speed in mounting the electronic components such as: a BGA component represented by, for example, CSP having solder bumps for forming an electronic circuit; or a QFP component having no solder bump for forming an electronic circuit and satisfies a reliable component mounting quality of a high productivity.

⑦ <sup>SUMMARY</sup> <sup>THE</sup> [DISCLOSURE] OF INVENTION

The present invention is constructed as follows to achieve the aforementioned object.

According to a first aspect of the present invention, there is provided an electronic component to be mounted on a printed board, characterized by comprising:

a plurality of electrical connecting portions provided on an electrical connecting surface of the electronic component and the printed board; and a reference mark that serves as a reference of arrangement positions of the electrical connecting portions.

According to a second aspect of the present invention, there is provided an electronic component according to the first aspect, characterized in that the reference mark of the electronic component is provided on the electrical connecting surface side facing a mounting position on the printed board.

According to a third aspect of the present invention, there is provided an electronic component according to the first aspect, characterized in that the reference mark of the electronic component is provided on

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Fig. 16A is a sectional view of a conventional BGA component having solder bumps and a printed board;

Fig. 16B is a bottom view of the BGA component;

Fig. 17 is a partially see-through perspective view of the component mounting apparatus of a prior art example;

Fig. 18 is a partially see-through perspective view of a component mounting apparatus of another prior art example;

Fig. 19 is a sectional view showing the mounting of a BGA component by the conventional component mounting apparatus shown in Fig. 18; and

Figs. 20A through 20J are views showing the BG connecting portion arrangement pattern on the connecting

surface of the conventional BGA component.

DETAILED DESCRIPTION OF  
 (16) BEST-MODE FOR CARRYING OUT THE INVENTION

Before the description of the present invention proceeds, it is to be noted that like parts are designated by like reference numerals throughout the accompanying drawings.

A first embodiment of the present invention will be described in detail below with reference to the drawings.

Fig. 1 is a perspective view showing an electronic component and the outline of a component mounting apparatus capable of implementing an electronic component mounting method, according to the first embodiment of the present invention. In this figure, the components that correspond

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conveyed to the outside by the conveyance rails 15 after a mounting ending process S10, the steps being described later.

Further, the component supplying section 16 of the electronic component mounting apparatus can be mounted with the tape-shaped parts cassette 16a, the bulk cassette 16b for components stored in a scattered form, the plate-shaped parts tray 16', and the like, which serve as a removable component set for continuously supplying the components.

Fig. 2 is a block diagram showing the outline of a control section for executing mounting control of the component mounting apparatus. In Fig. 2, reference numerals denote respectively, 20 a storage section provided with a mounting program storage section 20a and a component data storage section 20b, 21 an input/output control section, 22 a component supply control section, 23 a recognition control section, 24 a positioning control section, 25 a pressure control section, 26 a height control section, and 300 a CPU.

The mounting program storage section 20a stores: mounting data such as a mounting sequence, component names, mounting positions (X, Y,  $\theta$ ), and supply positions of components to be supplied; and a program for executing the mounting process. The component data storage section 20b stores information such as component names, component (appearance) shapes (widths, lengths, heights), colors, reference mark positions with respect to component body dimensions (appearance or external ends) or reference mark positions with respect to the centers of the components, patterns

(arrangement positions) of the lands of BG connecting portions with respect to the reference marks, reference mark shapes (the center of gravity and positions of the vertex and the sides in the case of a triangular reference mark; the center of gravity and positions of the corners and the sides in the case of a rectangular reference mark; the center or the center of gravity in the case of a circle or dot reference mark), the ball shape (including sphere, sphere diameter, and so on) in each arrangement position, information of ~~the~~ presence or absence of a ball~~/~~, and so on. The CPU 300 issues whole mounting commands and instructions to each <sup>of the</sup> driving units and so on. The input/output control section 21 is to execute input and output of the mounting program and the component data by manual input or by an FD or communications. It is otherwise acceptable to directly execute the input and the output of data of the actual X- and Y-positions, angle, pressure, and the like on the component supply control section 22, the positioning control section 24, the height control section 26, and the pressure control section 25, not by way of the input/output control section 21. The component supply control section 22 drives the component supply section of a tray, a cassette, or the like, and then supplies an appropriate component to a component supply position. The recognition control section 23 executes the recognition of the component, reference marks of the component and the board, IC marks, arrangement patterns, and so on, executes

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described with reference to Fig. 14A and Fig. 14B.

(1) On the lower surface of an IC chip 5b are preparatorily formed gold bumps 5d via aluminum electrodes 5c. This IC chip 5b is bonded with pressure via silver paste 5e on upper electrodes 5f of a single-layer or multi-layer carrier board 5a made of glass epoxy or ceramic and then encapsulated with resin to be formed into the complete

(2) BGA component 5. The BG connecting portions 6<sup>are</sup> to be (3) electrically connected to the upper electrodes 5f by wiring

5g that penetrate the carrier board 5a, and the reference marks 30 are formed simultaneously with each other on this carrier board 5a, as shown in Fig. 13A. Subsequently, the solder bumps 7 are formed. It is to be noted that the solder bumps 7 are not formed in the case of a bump-less component which needs no solder bump 7.

The electrical connecting portions of, for example, the lands and the BG connecting portions 6 often have a circular shape, and therefore, the reference mark 30 preferably has a triangular shape or the like other than the circular shape so as to facilitate the discrimination of the reference mark from the shape. If the triangular shape is adopted, it is easy to specify the direction of the triangle according to the positions of the sides and the positions of the vertexes. For example, if the reference mark 30 is constructed of a mark of one isosceles triangle defined so that the direction parallel to the base different from the equi-length sides is a Y-direction and the direction

mounting position of the printed board 1 on the mounting table 14 in a mounting position determining process (S5).

In a board mounting position recognizing process, (4) the target mounting position recognition marks  $3\frac{30}{\mu}$  of the printed board 1 shown in Fig. 3A is confirmed and recognized by the board recognizing section 13b as needed (S6).

In a determination (check) correcting process after the mounting position detection, the mounting position (9) is corrected by securing a high <sup>degree of</sup> accuracy through the mounting position determination correcting process together with the foregoing component inspection results (S7).

In a component mounting process, the mounting head 13 is lowered under the control of the height control section 26 so as to execute the mounting of the component 5 on the board 1 (S8).

In this stage, the diameters of the spheres are detected according to the inspection results of the sizes, variations, and so on of the solder bumps 7 at the BG connecting portions 6 in the case of the spherical solder bumps. Therefore, it is also allowed to obtain the average height of the BGA component 5 on the basis of the detected diameters, obtain a gap between the BGA component 5 and the printed board 1 through optimization and execute the calculation of the optimum control of the height control section 26 of the mounting head 13 or the optimum control of the pressure control section 25 for pressing the component in mounting as described in connection with the prior art



mounting and for a reduction in time when replacing the faultily mounted component and performing rearrangement in replenishing the component to be mounted.

(11)

5 Fig. 11A is a front view of a two-dimensional bar code provided on the surface opposite from the surface that has BG connecting portions of a BGA component according to a sixth embodiment of the present invention, while Fig. 11B is a side view of the above. The bar code is provided on the surface opposite from the connecting surface described in connection with the fifth embodiment. If the two-dimensional bar code 40 is ~~given to~~ <sup>provided on</sup> the upper surface of the BGA component 5 and a variety of information for mounting the components, such as the land pitch and positional information of the BG connecting portions of the various components are coded as the indicated information, then the mounting control of the mounting head height, the mounting speed, the mounting pressure control, and so on in the mounting stage can be executed for each component on the basis of the information as the checking and correcting processes in the component recognizing process (process S4) shown in Fig. 4. Furthermore, a two-dimensional bar code 40 having a larger size can be used by providing the bar code on the surface opposite from the connecting surface, and the information carrying area is enlarged to allow a wider variety of information to be provided. This operates favorably in controlling the mounting. If the amounts of deviation from the permissible range and the dropouts of the

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solder bumps are stored as information to be stored in the two-dimensional bar code 40 or another storage medium, then the information can be utilized as information for determining whether or not the component should be scrapped or reused with the solder bump reformed when the BGA component 5 is determined to be defective.

Fig. 12A shows two-dimensional bar code processing through a component inspecting process of a control section, while Fig. 12B is a view for explaining the two-dimensional bar code processing through a board recognizing process. The component inspecting process shown in Fig. 12A obtains the information of the component by two-dimensional bar code detection through the component inspecting process of the recognition control section 23 from a signal read from the component inspecting section 13a, and executes the component recognizing process. Also, in the board recognizing process shown in Fig. 12B, the component information is obtained by detecting the two-dimensional bar code from a signal from the board recognizing section 13b through the board recognizing process in the recognition control section 23. By sharing the two-dimensional bar code detecting process of the board recognizing section 13b and further sharing an optical detector of, for example, a camera or a laser scanner as the component recognizing section 13b for recognizing the reference mark 30 so as to read the two-dimensional bar code 40, the detection of the component inspecting section 13a becomes unnecessary.

This can reduce the mounting cycle time and improve the productivity as compared with the conventional component position detection, so that the component mounting can be achieved faster and more reliably to allow the quality to be improved.

Furthermore, the present invention can achieve the component mounting faster and more reliably by confirming the recognition mark(s) on the printed board in the recognizing process.

Furthermore, according to the present invention, the state of arrangement of the whole BG connecting portions, the shape of each solder bump, the dropout of the solder bump that causes the defective component mounting, and so on can be detected and checked easily and accurately at high speed by the reference mark(s), so that a reliable component mounting quality can be provided.

⑪ Furthermore, according to the present invention, the information of the coded reference mark(s) can assure an inexpensive and simple structure, without <sup>the necessity of</sup> providing ~~no~~ separate special device for executing detection, by virtue of the detection that is achieved and is also used for the recognition process.

Furthermore, according to the present invention, the component type in the electronic component mounting position can be confirmed to prevent the faulty mounting by virtue of the fact that at least one of the recognition marks on the printed board is the discrimination information

## ABSTRACT

③ Processing is started (S1), and control of  
 ④ mounting processes is successively executed by mounting  
 ⑤ program instructions of a storage section (S2). An  
 electronic component, <sup>such as a BGA component, and removal of</sup> is positioned <sup>the component</sup> with respect to a  
 mounting head <sup>positional position</sup> ~~taken out, and held (S3)~~. The BGA component  
 is positioned through positional detection of a reference  
 ⑥ mark and inspection, and the <sup>positional position</sup> ~~correcting~~ is executed by  
 10 checking the holding posture. Through the inspection using  
 the reference mark as a reference position, the dropout,  
 dislocation, shortage of solder amount of the solder bumps  
 of the component are subjected to <sup>quality</sup> quality check (S4). <sup>If of new</sup> ~~The~~ <sup>given</sup>  
<sup>not</sup> ~~normal~~ component is moved closer to the mounting position  
 15 of the printed board on a mounting table by a mounting head  
 (S5). A recognition mark in the target mounting position  
 of the printed board is confirmed and recognized (S6). By  
 determining the mounting position through mounting position  
 20 detection and component inspection result, the mounting  
 position is corrected (S7) and the height of the mounting  
 head is controlled and <sup>the component is</sup> mounted (S8). <sup>Depending on the</sup>  
 presence or absence of the component to be mounted, the  
 program flow proceeds to the process S1 for continuing the  
 25 processing or to the process S10 for ending (S9), and the  
 processing ends (S10).

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